

**Carrier based on granules produced from pyrogenically prepared silicon dioxides**

The present invention relates to the use of granules of pyrogenic silica as carriers. In addition to various other actions, the granules can have the function of a carrier for foodstuffs additives, such as dyestuffs, antioxidants, preservatives, emulsifiers, gelling agents, thickeners and binders, stabilizers, alkalis, acids, salts, antilumping agents, flavour intensifiers, sweeteners, aromas, feedstuffs additives, chemical intermediates and plant protection agents, such as, for example, herbicides, insecticides, fungicides and others.

It is known to employ spherical silicon dioxide particles as carriers, for example for feedstuffs additives (Sipernat 22, Bulletin Pigments No. 31, "Synthetic Silica as a Flow Acid and Carrier Substance", Degussa AG).

Disadvantages of the abovementioned silicon dioxide particles which are employed as carriers are their high water content, their too low purity and the poor flow properties of the loaded substance. Silicic acid esters, silica sols or silicates are employed as starting compounds, and then often lead to products of which the purity is not adequate for the desired intended uses because of considerable amounts of salts, so that an expensive washing is necessary.

The invention is therefore based on the object of providing spherical silicon dioxide particles for use as carriers which do not have the disadvantages mentioned and moreover meet the high demands of uses in respect of purity, product safety and flow properties.

The invention provides the use of granules based on pyrogenically prepared silicon dioxide as a carrier for substances chosen from the group consisting of foodstuffs additives, such as dyestuffs, antioxidants, preservatives, 5 emulsifiers, gelling agents, thickeners and binders, stabilizers, alkalis, acids, salts, antilumping agents, flavour intensifiers, sweeteners, aromas, feedstuffs additives, chemical intermediates and plant protection agents, such as herbicides, insecticides, fungicides and 10 others.

The invention also provides an adsorbate of granules based on pyrogenically prepared silicon dioxide and at least one substance chosen from the group consisting of foodstuffs additives, such as dyestuffs, antioxidants, preservatives, 15 emulsifiers, gelling agents, thickeners and binders, stabilizers, alkalis, acids, salts, antilumping agents, flavour intensifiers, sweeteners, aromas, feedstuffs additives, chemical intermediates and plant protection agents, such as herbicides, insecticides and fungicides.

20 The granules based on pyrogenically prepared silicon dioxide preferably have an average particle diameter of 10 to 120  $\mu\text{m}$  and a BET surface area of 40 to 400  $\text{m}^2/\text{g}$  (determination in accordance with DIN 66 131 with nitrogen).

25 The silicon dioxide granules furthermore preferably have the following physico-chemical characteristic data, which are determined as described in EP PS 0 725 037:

Pore volume: 0.5 to 2.5 ml/g

30 Pore size distribution: less than 5% of the total pore volume has a pore diameter of less than 5 nm, remainder meso- and macropores

pH: 3.6 to 8.5

Tamped density: 220 to 700 g/l.

Granules which are suitable for the use according to the invention and the preparation thereof are described, for example, in EP OS 0 727 037.

The granules can preferably have meso- and macropores, the 5 volume of the mesopores making up 10 to 80% of the total volume. The particle size distribution of the granules is preferably 80 vol.% larger than 8  $\mu\text{m}$  and 80 vol.% smaller than 96  $\mu\text{m}$ . In a preferred embodiment of the invention, the content of pores smaller than 5  $\mu\text{m}$  is not more than 5%, 10 based on the total pore volume.

The granules employed according to the invention can be prepared, for example, by dispersing pyrogenically prepared silicon dioxide, preferably silicon dioxide prepared from silicon tetrachloride by means of flame hydrolysis, in 15 water, spray drying the dispersion and optionally then heat-treating the resulting granules at a temperature of 150 to 1,100°C for a period of 1 to 8 h.

The dispersion in water preferably has a concentration of silicon dioxide of 5 to 25 wt.%, more preferably 5 to about 20 19.9 wt.%. The spray drying can be carried out at a temperature of 200 to 600°C, and disc atomizers or nozzle atomizers can be employed in this context. The heat treatment of the granules can be carried out either in a static bed, such as, for example, in chamber ovens, or in 25 an agitated bed, such as, for example, rotary tubular dryers.

The pyrogenic silicon dioxide serving as the starting compound is prepared by a process in which a volatile silicon compound is injected into an oxyhydrogen gas flame 30 of hydrogen and air. Silicon tetrachloride is used in most cases. This substance hydrolyses to silicon dioxide and hydrochloric acid under the influence of the water formed during the oxyhydrogen gas reaction. After leaving the flame the silicon dioxide enters into a so-called

coagulation zone, in which the silicon dioxide primary particles and primary aggregates agglomerate. The product present as a type of aerosol in this stage is separated from the gaseous concomitant substances in cyclones and 5 then after-treated with damp hot air. The residual hydrochloric acid content can be lowered to below 0.025% by this process.

The granules based on pyrogenically prepared silicon dioxide can be silanized. The carbon content of the 10 granules is then preferably 0.3 to 15.0 wt.%. Halogenosilanes, alkoxy silanes, silazanes and/or siloxanes can be employed for the silanization.

The following substances can be employed in particular as halogenosilanes:

15 Halogeno-organosilanes of the type  $X_3Si(C_nH_{2n+1})$

$X = Cl, Br$   
 $n = 1 - 20$

Halogeno-organosilanes of the type  $X_2(R')Si(C_nH_{2n+1})$

20  $X = Cl, Br$   
 $R' = alkyl$   
 $n = 1 - 20$

Halogeno-organosilanes of the type  $X(R')_2Si(C_nH_{2n+1})$

25  $X = Cl, Br$   
 $R' = alkyl$   
 $n = 1 - 20$

Halogeno-organosilanes of the type  $X_3Si(CH_2)_m-R'$

X = Cl, Br

m = 0,1 - 20

R' = alkyl, aryl (e.g. -C<sub>6</sub>H<sub>5</sub>)

-C<sub>4</sub>F<sub>9</sub>, -OCF<sub>2</sub>-CHF-CF<sub>3</sub>, -C<sub>6</sub>F<sub>13</sub>, -O-CF<sub>2</sub>-CHF<sub>2</sub>

5 -NH<sub>2</sub>, -N<sub>3</sub>, -SCN, -CH=CH<sub>2</sub>,

-OOC(CH<sub>3</sub>)C=CH<sub>2</sub>

-OCH<sub>2</sub>-CH(O)CH<sub>2</sub>

—NH—CO—N—CO—(CH<sub>2</sub>)<sub>5</sub>—

—NH-COO-CH<sub>3</sub>, -NH-COO-CH<sub>2</sub>-CH<sub>3</sub>, -NH-(CH<sub>2</sub>)<sub>3</sub>Si(OR)<sub>3</sub>

10 -S<sub>X</sub>-(CH<sub>2</sub>)<sub>3</sub>Si(OR)<sub>3</sub>

Halogeno-organosilanes of the type (R)X<sub>2</sub>Si(CH<sub>2</sub>)<sub>m</sub>-R'

X = Cl, Br

R = alkyl

m = 0,1 - 20

15 R' = alkyl, aryl (e.g. -C<sub>6</sub>H<sub>5</sub>)

-C<sub>4</sub>F<sub>9</sub>, -OCF<sub>2</sub>-CHF-CF<sub>3</sub>, -C<sub>6</sub>F<sub>13</sub>, -O-CF<sub>2</sub>-CHF<sub>2</sub>

-NH<sub>2</sub>, -N<sub>3</sub>, -SCN, -CH=CH<sub>2</sub>,

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—NH—CO—N—CO—(CH<sub>2</sub>)<sub>5</sub>—

20 —NH-COO-CH<sub>3</sub>, -NH-COO-CH<sub>2</sub>-CH<sub>3</sub>, -NH-(CH<sub>2</sub>)<sub>3</sub>Si(OR)<sub>3</sub>

-S<sub>X</sub>-(CH<sub>2</sub>)<sub>3</sub>Si(OR)<sub>3</sub>

Halogeno-organosilanes of the type (R)<sub>2</sub>X Si(CH<sub>2</sub>)<sub>m</sub>-R'

X = Cl, Br

25 R = alkyl

m = 0,1 - 20

R' = alkyl, aryl (e.g. -C<sub>6</sub>H<sub>5</sub>)

-C<sub>4</sub>F<sub>9</sub>, -OCF<sub>2</sub>-CHF-CF<sub>3</sub>, -C<sub>6</sub>F<sub>13</sub>, -O-CF<sub>2</sub>-CHF<sub>2</sub>

-NH<sub>2</sub>, -N<sub>3</sub>, -SCN, -CH=CH<sub>2</sub>,

30 -OOC(CH<sub>3</sub>)C=CH<sub>2</sub>

-OCH<sub>2</sub>-CH(O)CH<sub>2</sub>

—NH—CO—N—CO—(CH<sub>2</sub>)<sub>5</sub>—

$-\text{NH}-\text{COO}-\text{CH}_3$ ,  $-\text{NH}-\text{COO}-\text{CH}_2-\text{CH}_3$ ,  $-\text{NH}- (\text{CH}_2)_3\text{Si}(\text{OR})_3$   
 $-\text{Si}_x-(\text{CH}_2)_3\text{Si}(\text{OR})_3$

The following substances can be employed in particular as alkoxysilanes:

5      Organosilanes of the type  $(\text{RO})_3\text{Si}(\text{C}_n\text{H}_{2n+1})$

R = alkyl

n = 1 - 20

Organosilanes of the type  $\text{R}'_x(\text{RO})_y\text{Si}(\text{C}_n\text{H}_{2n+1})$

R = alkyl

10     R' = alkyl

n = 1 - 20

x+y = 3

x = 1,2

y = 1,2

15     Organosilanes of the type  $(\text{RO})_3\text{Si}(\text{CH}_2)_m-\text{R}'$

R = alkyl

m = 0,1 - 20

R' = alkyl, aryl (e.g.  $-\text{C}_6\text{H}_5$ )

$-\text{C}_4\text{F}_9$ ,  $\text{OCF}_2-\text{CHF}-\text{CF}_3$ ,  $-\text{C}_6\text{F}_{13}$ ,  $-\text{O}-\text{CF}_2-\text{CHF}_2$

20      $-\text{NH}_2$ ,  $-\text{N}_3$ ,  $-\text{SCN}$ ,  $-\text{CH}=\text{CH}_2$ ,

$-\text{OOC}(\text{CH}_3)\text{C}=\text{CH}_2$

$-\text{OCH}_2-\text{CH}(\text{O})\text{CH}_2$

$\text{---NH---CO---N---CO---}(\text{CH}_2)_5\text{---}$

$-\text{NH}-\text{COO}-\text{CH}_3$ ,  $-\text{NH}-\text{COO}-\text{CH}_2-\text{CH}_3$ ,  $-\text{NH}- (\text{CH}_2)_3\text{Si}(\text{OR})_3$

25      $-\text{Si}_x-(\text{CH}_2)_3\text{Si}(\text{OR})_3$

Organosilanes of the type  $(\text{R}'')_x(\text{RO})_y\text{Si}(\text{CH}_2)_m-\text{R}'$

R'' = alkyl

x+y = 2

30     x = 1,2

$y = 1, 2$

$R' =$  alkyl, aryl (e.g.  $-C_6H_5$ )

$-C_4F_9$ ,  $-OCF_2-CHF-CF_3$ ,  $-C_6F_{13}$ ,  $-O-CF_2-CHF_2$

$-NH_2$ ,  $-N_3$ ,  $-SCN$ ,  $-CH=CH_2$ ,

5  $-OOC(CH_3)C = CH_2$

$-OCH_2-CH(O)CH_2$

$\boxed{-NH-CO-N-CO-(CH_2)_5-}$

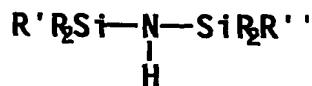
$-NH-COO-CH_3$ ,  $-NH-COO-CH_2-CH_3$ ,  $-NH-(CH_2)_3Si(OR)_3$

$-S_x-(CH_2)_3Si(OR)_3$

10 The silane Si 108  $[(CH_3O)_3-Si-C_8H_{17}]$  trimethoxyoctylsilane can preferably be employed as the silanizing agent.

The following substances can be employed in particular as silazanes:

Silazanes of the type:



15

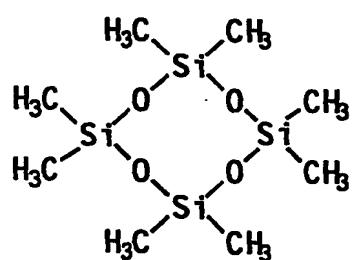
$R =$  alkyl

$R' =$  alkyl, vinyl

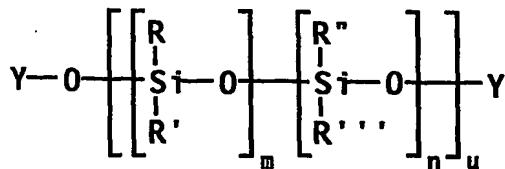
and, for example, hexamethyldisilazane.

20 The following substances can be employed in particular as siloxanes:

Cyclic polysiloxanes of the type D 3, D 4, D 5, e.g. octamethylcyclotetrasiloxane = D 4



Polysiloxanes or silicone oils of the type:



R = alkyl, aryl,  $(CH_2)_n - NH_2$ , H

R' = alkyl, aryl,  $(CH_2)_n - NH_2$ , H

5 R'' = alkyl, aryl,  $(CH_2)_n - NH_2$ , H

R''' = alkyl, aryl,  $(CH_2)_n - NH_2$ , H

Y =  $CH_3$ , H,  $C_nH_{2n+1}$  where n=1-20

Y =  $Si(CH_3)_3$ ,  $Si(CH_3)_2H$

$Si(CH_3)_2OH$ ,  $Si(CH_3)_2(OCH_3)$

10  $Si(CH_3)_2(C_nH_{2n+1})$  where n=1-20

m = 0,1,2,3,... $\infty$

n = 0,1,2,3,... $\infty$

u = 0,1,2,3,... $\infty$

15 The silanization can be carried out by a procedure in which the granules are sprayed with the silanizing agent, which can optionally be dissolved in an organic solvent, such as, for example, ethanol, and the mixture is then heat-treated at a temperature of 105 to 400°C over a period of 1 to 6 h.

20 An alternative method of the silanization of the granules can be carried out by a procedure in which the granules are treated with the silanizing agent in vapour form and the mixture is then heat-treated at a temperature of 200 to 800°C over a period of 0.5 to 6 h. The heat treatment can 25 be carried out under an inert gas, such as, for example, nitrogen.

The silanization can be carried out continuously or batchwise in heatable mixers and dryers with spray devices. Suitable devices can be, for example: plough share mixers 30 or plate, fluidized bed or flow-bed dryers.

By varying the starting substances, the conditions during spraying, the heat treatment and the silanization, the physico-chemical parameters of the granules, such as the specific surface area, the particle size distribution, the 5 pore volume, the tamped density and the silanol group concentration, pore distribution and pH, can be modified within the stated limits.

The invention also provides:

- Dyestuff comprising granules based on pyrogenically prepared silicon dioxide.
- 10 Antioxidant comprising granules based on pyrogenically prepared silicon dioxide.
- Preservative comprising granules based on pyrogenically prepared silicon dioxide.
- 15 Emulsifier comprising granules based on pyrogenically prepared silicon dioxide.
- Gelling agent comprising granules based on pyrogenically prepared silicon dioxide.
- Thickener comprising granules based on pyrogenically 20 prepared silicon dioxide.
- Binder comprising granules based on pyrogenically prepared silicon dioxide.
- Stabilizer comprising granules based on pyrogenically 25 prepared silicon dioxide.
- Alkali comprising granules based on pyrogenically prepared silicon dioxide.
- Acids comprising granules based on pyrogenically prepared silicon dioxide.

- Salts comprising granules based on pyrogenically prepared silicon dioxide.
- Antilumping agent comprising granules based on pyrogenically prepared silicon dioxide.
- 5 - Flavour intensifier comprising granules based on pyrogenically prepared silicon dioxide.
- Sweetener comprising granules based on pyrogenically prepared silicon dioxide.
- Aroma comprising granules based on pyrogenically prepared silicon dioxide.
- 10 - Feedstuffs additives comprising granules based on pyrogenically prepared silicon dioxide.
- Chemical intermediates comprising granules based on pyrogenically prepared silicon dioxide.
- 15 - Plant protection agents comprising granules based on pyrogenically prepared silicon dioxide.
- Herbicides comprising granules based on pyrogenically prepared silicon dioxide.
- Insecticides comprising granules based on pyrogenically prepared silicon dioxide.
- 20 - Fungicides comprising granules based on pyrogenically prepared silicon dioxide.

Foodstuffs additives can be:

Dyestuffs, such as, for example:

- E100 Curcumin
- E101 Riboflavin, Lactoflavin
- 5 E102 Tartrazine
- E104 Quinoline Yellow
- E110 Sunset Yellow S (azo dyestuff)
- E120 Carminic acid, Cochineal
- 10 E122 Azorubine (azo dyestuff)
- E123 Amaranth (azo dyestuff)
- E124 Ponceau 4R (azo dyestuff)
- E127 Erythrosine
- E131 Patent Blue V
- E132 Indigotine, Indigo Carmine
- 15 E140 Chlorophylls a + b
- E141 Chlorophylls und Chlorophyllins,  
copper complexes
- E142 Acid Brilliant Green BS
- E150 Caramel, Sugar colour, Rum colour
- 20 E151 Brilliant Black BN (azo dyestuff)
- E153 Charcoal, medicinal
- E160 Carotenoids
- E160a Beta-Carotene, Gamma-Carotene
- E160b Bixin, Norbixin, (Annatto), Orlean
- 25 E160c Capsanthin, Capsorubin
- E160d Lycopene
- E160e Beta-Apo-8'-Carotenal (C30)
- E160f Beta-Apo-8'-Carotenoic Acid Ethyl Ester
- E161 Xanthophylls
- 30 E161a Flavoxanthin
- E161b Lutein
- E161c Cryptoxanthin
- E161d Rubixanthin
- E161e Violaxanthin
- 35 E161f Rhodoxanthin

E161g Canthaxanthin  
E162 Betanin, Beetroot Red  
E163 Anthocyan  
E172 Iron oxide, iron hydroxide  
5 E173 Aluminium  
E174 Silver  
E175 Gold  
E180 Pigment Rubine BK, Lithol Rubine

10 Antioxidants can be:

E220 Sulfurous acid, sulfur dioxide  
E221 Sodium sulfite  
E222 Sodium hydrogen sulfite  
E223 Sodium disulfite  
15 E224 Potassium disulfite  
E300 Ascorbic acid  
E301 Sodium ascorbate  
E302 Calcium ascorbate  
E304 Ascorbyl palmitate  
20 E306 Tocopherol-containing extracts of natural  
origin  
E307 alpha-Tocopherol  
E308 gamma-Tocopherol  
E309 delta-Tocopherol  
25 E310 Propyl gallate  
E311 Octyl gallate  
E312 Dodecyl gallate  
E320 Butylhydroxyanisole (BHA)  
E321 Butylhydroxytoluene (BHT)  
30 E330 Citric acid  
E331 Sodium citrate  
E332 Potassium citrate  
E333 Calcium citrate  
E472c Citric acid esters  
35 Ethoxiquin

Preservatives can be:

- E200 Sorbic acid
- E201 Sodium sorbate
- E202 Potassium sorbate
- 5 E203 Calcium sorbate
- E210 Benzoic acid
- E211 Sodium benzoate
- E212 Potassium benzoate
- E213 Calcium benzoate
- 10 E214 Ethyl 4-hydroxybenzoate
- E215 Ethyl 4-hydroxybenzoate, sodium salt
- E216 Propyl 4-hydroxybenzoate
- E217 Propyl 4-hydroxybenzoate, sodium salt
- E218 Methyl 4-hydroxybenzoate
- 15 E219 Methyl 4-hydroxybenzoate, sodium salt
- E220 Sulfurous acid, sulfur dioxide
- E221 Sodium sulfite
- E222 Sodium hydrogen sulfite
- E223 Sodium disulfite
- 20 E224 Potassium disulfite
- E236 Formic acid
- E280 Propionic acid
- E281 Sodium propionate
- E282 Calcium propionate
- 25 E283 Potassium propionate

Emulsifiers can be:

- E322 Lecithin
- E442 Ammonium salts of phosphatidic acids
- E471 Edible fatty acids, mono- and
- 30 diglycerides
- E472 Esters of E471
- E472a Acetic acid esters
- E472b Lactic acid esters
- E472c Citric acid esters
- 35 E472d Tartaric acid esters

- E472e Diacetyl tartaric acid esters
- E472f Tartaric-acetic acid esters
- E473 Sucrose esters of edible fatty acids
- E474 Sugar glycerides
- 5 E475 Polyglycerol esters of edible fatty acids
- E476 Polyglycerol esters of polycondensed ricinoleic acid
- E477 Propylene glycol esters of edible fatty acids
- 10 E481 Sodium stearoyllactylate
- E482 Calcium stearoyllactylate
- E487 Sodium lauryl sulfate

Gelling agents, thickeners and binders and stabilizers can  
15 be:

- E400 Alginic acid
- E401 Sodium alginate
- E402 Potassium alginate
- E403 Ammonium alginate
- 20 E404 Calcium alginate
- E405 Propylene glycol alginate
- E406 Agar-agar
- E407 Carrageenan
- E410 Carob bean flour
- 25 E412 Guar flour
- E413 Tragacanth
- E414 Gum arabic
- E415 Xanthan
- E416 Karaya gum
- 30 E417 Tara gum
- E440 Pectins
- E460a Cellulose, microcrystalline
- E460b Cellulose, powdered
- E461 Methylcellulose
- 35 E463 Hydroxypropylcellulose

5                   E464 Hydroxypropylmethycellulose  
                  E465 Methylmethylethylcellulose  
                  E466 Carboxymethylcellulose  
                  E551 Silicon dioxide  
10                  E1411 Di-starch phosphate I  
                  E1412 Di-starch phosphate II  
                  E1413 Di-starch phosphate, phosphated  
                  E1414 Di-starch phosphate, acetylated  
                  E1420 Mono-starch acetate I  
                  E1421 Mono-starch acetate II  
                  E1422 Di-starch adipate, acetylated  
                  E1423 Di-starch glycerol, acetylated  
                  E1430 Di-starch glycerol  
                  E1440 Hydroxypropyl-starch  
15                  E1441 Hydroxypropyl-di-starch glycerol  
                  E1442 Hydroxypropyl-di-starch phosphate

Alkalies, acids and salts can be:

20                  E170 Calcium carbonate  
                  E260 Acetic acid  
                  E261 Potassium acetate  
                  E262 Sodium diacetate  
                  E263 Calcium diacetate  
                  E270 Lactic acid  
25                  E296 Malic acid  
                  E325 Sodium lactate  
                  E326 Potassium lactate  
                  E327 Calcium lactate  
                  E330 Citric acid  
30                  E331 Sodium citrate  
                  E332 Potassium citrate  
                  E333 Calcium citrate  
                  E334 Tartaric acid  
                  E335 Sodium tartrate  
35                  E336 Potassium tartrate

E337 Potassium sodium tartrate  
E354 Calcium tartrate  
E338 Orthophosphoric acid  
E339 Sodium orthophosphate  
5 E340 Potassium orthophosphate  
E341 Calcium orthophosphate  
E343 Magnesium orthophosphate  
E350 Sodium malate  
E351 Potassium malate  
10 E352 Calcium malate  
E450 Salts of di-, tri- and polyphosphoric acid (di-, tri- and polyphosphates)  
E500 Sodium carbonate  
E501 Potassium carbonate  
15 E503 Ammonium carbonate  
E504 Magnesium carbonate  
E507 Hydrochloric acid  
E508 Potassium chloride  
E509 Calcium chloride  
20 E510 Ammonium chloride  
E514 Sodium sulfate  
E515 Potassium sulfate  
E516 Calcium sulfate  
E524 Sodium hydroxide  
25 E525 Potassium hydroxide  
E526 Calcium hydroxide  
E527 Ammonium hydroxide  
E528 Magnesium hydroxide  
E529 Calcium oxide  
30 E530 Magnesium oxide  
E541 Sodium aluminium phosphate  
E574 Gluconic acid  
E575 Glucono-delta-lactone  
E576 Sodium gluconate  
35 E577 Potassium gluconate  
E578 Calcium gluconate

Antilumping agents can be:

5                   E170 Calcium carbonate  
                  E341 Calcium orthophosphate  
                  E470 Edible fatty acids, sodium, potassium and  
                  calcium salts  
                  E504 Magnesium carbonate  
                  E535 Sodium ferrocyanide  
                  E536 Potassium ferrocyanide  
                  E538 Calcium ferrocyanide

10

Flavour intensifiers can be:

15                   E621 Sodium glutamate  
                  E622 Potassium glutamate  
                  E623 Calcium glutamate  
                  E624 Magnesium glutamate  
                  E625 Ammonium glutamate  
                  E627 Sodium guanylate  
                  E628 Potassium guanylate  
                  E629 Calcium guanylate  
                  E630 5'-Inosinic acid  
                  E631 Sodium inosinate  
                  E632 Potassium inosinate  
                  E633 Calcium inosinate

25

Sweeteners can be:

30                   E950 Acesulfame-K  
                  E951 Aspartame  
                  E952 Cyclamate  
                  E954 Saccharin  
                  E957 Thaumatin

## Aromas:

Abriceine  
Acetanisole cryst.  
Acetophenone pure  
5 Agar wood D50092NS  
Agrumen aldehyde 6947L  
Agrumex HC  
Agrumex LC  
Agrumovert 10897 C/J  
10 Aldehyde C 6 nat.  
Aldehyde C11 MOA  
Aldehyde C12 MNA  
Aldehyde C14 so-called  
Aldehyde C16 so-called  
15 Aldehyde C18 so-called/Abricolin  
Alcohol C 6 nat.  
Alcohol C 8  
Alcohol C 9  
Alcohol C10  
20 Alcohol C12  
Allinat/Allyl isothiocyanate  
Allinat/Allyl isothiocyanate (stab.)  
Allyl caproate  
Allyl caproate kosher  
25 Allyl cyclohexylpropionate  
Allyl heptylate  
Allyl phenoxyacetate  
Amarocit ®  
Ambre 83LN DB10028  
30 Ambrebois D50407  
Ambrettia C  
Ambrettolide  
Ambrinol S  
Ambroxid cryst.  
35 Ananas Coeur D50214  
Anethol NPU 21/22°C

Anethol supra 21.5°C  
Anisaldehyde pure  
Anisyl alcohol  
Anisole  
5 Anisyl acetate  
Apple 74180C PM  
Apriconia 28855P extra PM  
Baldrian Identoil B  
Basilicum Synthessence  
10 Bay Identoil  
Benzalacetone  
Benzaldehyde  
Benzaldehyde dd  
Benzophenone cryst.  
15 Benzyl acetate  
Benzyl acetone  
Benzyl alcohol dd  
Benzyl alcohol FR  
Benzyl benzoate H&R  
20 Benzyl benzoate M  
Benzyl cinnamate  
Benzyl formate  
Benzyl propionate  
Benzyl salicylate  
25 Bergamot Identoil colourless  
Bergamot Synthessence Afric.  
Blackberry D50260E  
Bois de Cachemire D50008  
Bois Doux 78008SP PM  
30 Boronal  
Butyric acid nat.  
Butyl butyrate  
Cacao et Chocolat D50546B  
Cajeput Identoil  
35 Calmus Synthessence asarone-free  
Cananga Identoil  
Capric acid nat.

Caproic acid nat.  
Caramel acetate  
Cardamom R Identoil  
Cardamom Synthessence  
5 Cassia Identoil  
Cassia Identoil B dark  
Cassis D50060B  
Cedar Leaves Identoil  
Chloracetophenone para  
10 Chrysantheme  
Cinnamyl acetate  
Citral FF  
Citron R  
Citrone Synthessence FF  
15 Citronella Identoil  
Citronell Identoil  
Citronellyl tiglinate  
Citronitrile  
Citrowanil® B  
20 Citrozone D50620B  
Citrylal  
Citrylal E  
Clarifruit D50757  
Clarion Base D50774  
25 Coriander Identoil  
Corps 98N DB10025  
Corps Racine VS  
Costus Synthessence  
Coumarone  
30 Cumin Synthessence  
Cypress Identoil  
Damascenone beta nat. 1% in EtOH  
Datilat  
Decalactone gamma nat.  
35 Decalyl acetate beta  
Diacetyl nat.  
Dibenzosuberenone

Dibenzosuberone  
Dibenzyl ether  
Diethyl phthalate (DEP)  
Dihydrocoumarin  
5 Dimethyl anthranilate  
Dimethyl benzyl carbonyl butyrate  
Dimethyl sulfide nat.  
Diphenyl oxide  
Silver Fir Needle Identoil  
10 Silver Fir Needle Identoil B  
Oak Moss Resin D50342  
Strawberry D50026C  
Acetic acid nat.  
Estragon Identoil  
15 Ethoxyfuranone  
Ethyl 2-methylbutyrate nat.  
Ethyl 2-methylbutyrate  
Ethyl acetate nat.  
Ethyl acetoacetate  
20 Ethyl benzoate  
Ethyl butyrate  
Ethyl butyrate nat.  
Ethyl caproate kosher  
Ethyl caproate nat.  
25 Ethyl caprylate  
Ethyl caprylate nat.  
Ethyl cinnamate  
Ethyl formate  
Ethyl heptylate  
30 Ethyl isovalerate  
Ethyl phenylacetate  
Ethyl propionate  
Ethyl salicylat  
Eucalyptol  
35 Eucalyptus Oil Globulus BP  
Eugenol  
Eugenol methyl ether

Farenal  
Fennel oil techn.  
Feuilles de Tomate 79569PM  
Spruce Green 8001S  
5 Spruce Needle Identoil B sib.  
Spruce Needle Identoil sib.  
Filbertone G  
Fir Balsam DM  
Fleur de Cassis SBU PM  
10 Floropal  
Florophyll 10183  
Fragolane  
Framboson 10583F  
Frutinat  
15 Galbanum Synthessence  
Galbanum Synthresin B  
Geranium Identoil Afric.  
Geranium Identoil Bourbon  
Geranyl tiglinate  
20 Globalide 100%  
Globanone 50% DEP  
Globanone 50% DPG  
Globanone 50% IPM  
Grapefruit D50075N  
25 Grapefruit Identoil D61286G  
Green Honey Melon D50315  
Guave 10875N  
Helichrysum Synthessence  
Herbaflorat  
30 Hexyl acetate  
Hexyl acetate nat.  
Hexyl salicylate  
Hydrocitronitrile  
Indian Spice 10898  
35 Indoflor H&R cryst.  
Indole FF  
Ginger oil spec. D40393S

Ionone pure 100%  
Iris Synthresin H&R  
Irolene P  
Isoamyl acetate G  
5 Isoamyl acetate nat.  
Isoamyl butyrate  
Isoamyl butyrate nat.  
Isoamyl isobutyrate nat.  
Isoamyl isovalerate  
10 Isoananate  
Isobornyl acetate  
Isobutyric acid nat.  
Isobutyl acetat nat.  
Isobutylquinoline  
15 Isobutylquinoline 54  
Isoeugenol methyl ether  
Isotabac naturelle LN DB10038  
Jasmaphrunat  
Camomile Identoil blue  
20 Camomile rom. Synthessence  
Pine Needle Identoil  
Pine Needle Identoil B  
Pine Needle Identoil B P  
Kiwi D50195PM  
25 Cresol methyl ether para  
Lactojasmon  
Lavandin Identoil 30/32%  
Lavandin Identoil type French 30/32%  
Lavandin Provence D50817  
30 Lavender Identoil type Mt. Blanc 40/42%  
Lavender oil type Mt. Blanc 40/42%  
Leguminal  
Limonene d pure  
Loganberry D50398N PM  
35 Bay Leaf Oil D50286  
Mace Oil extra  
Macrolide®

Macrolide® supra  
Madranol  
Magnolan  
Majantol  
5  
Mandaril  
Manderine Synthessence  
Mango D50436PM  
Maracuja D50042E PM  
Marjoliane N DB10018  
10  
Mayciane N DB10023  
Melissa Identoil German so-called  
Menthol D dist.  
Menthol liquid  
Menthol rac.  
15  
Menthol rac. PH  
Menthol-1 dest.  
Menthol-1 H&R compacted  
Menthol oil  
Menthone-1/Isomenthone-d  
20  
Menthyl acetate-1  
Metaxa D50247C  
Methyl ethylpyrazine-2,3  
Methyl 2-methylbutyrate  
Methylacetophenone para  
25  
Methylacetophenone para supra  
Methyl anthranilate  
Methyl benzoate H&R  
Methyl benzoate techn. pure  
Methyl betanaphthyl ketone cryst.  
30  
Methylbutyric acid-2 nat.  
Methyl cinnamate  
Methyl phenylacetate  
Methyl salicylate  
Methyl cinnamaldehyde alpha  
35  
Miel Blanc N DB10024  
Musk Seed Synthessence  
Mugetanol

Mugofleur D50444PM  
Clary Sage Identoil  
Clary Sage Identoil B  
Carnation Flower Identoil  
5 Clove Leaf Identoil dark  
Clove Leaf Oil deg.  
Neononyl acetate  
Neroli Identoil  
Nerolin Yara Yara cryst.  
10 Neroli oil 4663  
Olibanum Synthresin  
Orange Identoil TSA  
Orange oil spec. D40393P  
Origanum Identoil  
15 Oryclon extra  
Oryclon special  
Osmanthia 353  
Ozonil  
Palisandal  
20 Palisandin  
Palmarosa Synthessence  
Pastinak Synthessence  
Patchouli Synthessence N  
Patchouli oil deg. DM  
25 Pear D50313A PM  
Peru Balsam Identoil  
Peru balsam art. H&R  
Petitgrain Bigarade Synthessence  
Petitgrain Identoil R  
30 Peach D40110PM  
Plum D50424  
Phenirate  
Phenoxyethyl alcohol/atosol  
Phenylacetaldehyde 100%  
35 Phenylacetaldehyde dimethyl acetal  
Phenylethyl acetate  
Phenylethyl alcohol benzyl alcohol-free

Phenylethyl alcohol pure.  
Phenylethyl cinnamate cryst.  
Phenylethyl isobutyrate  
Phenylethyl phenylacetate  
5 Phenylpropyl alcohol  
Pimento Identoil  
Pineapple acetate  
Poivre Coeur H&R PM  
Poivron N DB10029  
10 Prenyl acetate  
Prenyl salicylate  
Profarnesal  
Projasmon P  
Propionic acid nat.  
15 Propyl acetate nat.  
Prunol N DB10027  
Pyroprunat  
Rain Forest D50339C PM  
Resedafol  
20 Rosaphen  
Rose Booster D50221A  
Rose F50048R PG  
Rosemary Identoil  
Rosemary Identoil Spanish  
25 Rosewood Braz. Identoil  
Sage Identoil Span.  
Sage Identoil Span.  
Sandalwood S.E.A. D50820  
Sandel 80  
30 Sandel extra  
Sandel Forte  
Sandel H&R  
Sandel H&R ECO  
Sandel H&R super  
35 Sandel SP  
Sandel type East Ind.  
Sandalwood type East Ind.

Sandolene H&R  
Spike Identoil  
Styrax Identoil D50186  
Styrenyl acetate  
5 Sweet Amber D50807  
Tobacco aroma H&R D50799  
Teatree D50780A  
Thyme Identoil  
Thyme red Identoil  
10 Thyme Synthabsolue  
Thymol dist.  
Thymol cryst. H&R  
Thymol cryst. PH  
Tonca Synthresin  
15 Vanillin nat.  
Verbena Identoil type French  
Verdeflora D50375D  
Verdural F  
Vertocitral  
20 Vertocitral C  
Vertosine  
Vetiver Identoil J  
Juniper berry Identoil 10900  
Juniper berry Synthessence  
25 Willow fragrance 6103CB HG  
Wintergreen oil  
Ylang 10372 MT  
Ylang Ylang Identoil Bourbon I  
Ylang Ylang Identoil Bourbon II  
30 Ylang Ylang Identoil Bourbon III  
Cinnamaldehyde  
Cinnamaldehyde nat.  
Cinnamyl alcohol  
Cinnamon leaf Identoil  
35 Cinnamon bark Identoil

Feedstuffs additives can be:

	Choline chloride solution
	Vitamin E acetate
	Formic acid
5	Acetic acid
	Propionic acid
	Phosphoric acid
	Fat concentrates
	Ethoxiquin
10	Molasses
	Hop extract
	Tagetes extract
	Lecithin
	Whey
15	Calcium formiate
	Urea
	Milk substitute
	Trace elements
	Vitamins

20

	Chemical intermediates can be:
	1,2-Propylene glycol
	Acrylic acid
	Adipic acid
25	Adipic anhydride
	Formic acid
	Formic anhydride
	Benzoic acid
	Succinic acid
30	Butanoic acid
	Butanoic anhydride
	Caproic acid
	Dimer fatty acid
	Dimer fatty acid anhydride

Dipentaerythritol  
Erucic acid  
Acetic acid  
Acetic anhydride  
5 Ethylene glycol  
Fumaric acid  
Glutaric acid  
Glycerol  
Isophthalic acid  
10 Isophthalic anhydride  
Lauric acid  
Linolenic acid  
Linoleic acid  
Maleic acid  
15 Maleic anhydride  
Malonic acid  
Myristic acid  
Oleic acid  
Oxalic acid  
20 Palmitic acid  
Pentaerythritol  
Phthalic acid  
Phthalic anhydride  
Propionic acid  
25 Stearic acid  
Terephthalic acid  
Terephthalic anhydride  
Trimethylolpropane  
Valeric acid  
30 Bisphenol A  
Epichlorohydrin  
o-Cresol  
Phenol novolaks  
Styrene  
35  $\alpha$ -Methylstyrene  
Vinyltoluene  
Methyl methacrylate

Divinylbenzene  
Diallyl phthalate  
Diisocyanates  
Toluene-diisocyanates  
5 Cyclohexanone  
Methylcyclohexanone  
Acetone  
Butanone  
Acetophenone  
10 Indene  
Coumarone (benzofuran)  
2-Methylindene  
2-Methylcoumarone  
Methylstyrene  
15 Cyclopentadiene  
Dicyclopentadiene  
Heteropolysaccharides  
Arabinose  
Galactose  
20 Glucoronic acid  
Mannose  
Rhamnose  
Xylose  
Resinol acids  
25 Resinols  
Resinotannols  
Resenes  
Terpenes  
Diterpenes  
30 Triterpenes  
Sesquiterpenes  
Resin esters  
Resin soaps  
Alcohols  
35 Phenol derivatives  
Hydroquinone derivatives  
Quinoline derivatives

## Naturally occurring resins:

Acaroid resin  
Asa foetida  
Benzoin resin  
5 Amber  
Bitumen  
Canada balsam  
China lacquer  
Copaiva balsam  
10 Dammar resin  
Dragon's blood resin  
Elemi  
Galbanum  
Gutti  
15 Jalap resin  
Japan lacquer  
Kauri copal  
Colophony  
Copal  
20 Labdanum  
Manila copal  
Mastix  
Myrrh  
Olibanum  
25 Opopanax  
Pernambuco balsam  
Peru balsam  
Sandarac  
Shellac  
30 Styrax  
Tolu balsam  
Terpentine

## Synthetic resins:

35 Hydrocarbon resins  
Urea resins

Alkyd resins  
Epoxy resins  
Melamine resins  
Melamine-formaldehyde resins  
5 Hexamethylolmelamine resins  
Melamine-phenol resins  
Melamine-urea resins  
Phenolic resins  
Polyester resins  
10 Unsaturated polyester resins  
Polyurethane resins  
Ketone resins  
Coumarone-indene resins  
Isocyanate resins  
15 Polyamide resins  
Terpene-phenol resins  
Epoxy resins  
Rubber

Additives:

20 Wetting agents  
Desiccants  
Antifloating agents  
Antiskinning agents  
Hardening accelerators  
25 Hardening retardants  
Expanding agents  
Sealants  
Water softeners  
Deoxygenating agents  
30 Buffers  
Polishing agents  
Antiageing agents  
Antioxidants  
Antiozonants  
35 Plasticizers

Deodorizers  
Inhibitors  
Passivating agents  
Pickling inhibitors  
5 Anticorrosion agents  
Antistatics  
Stabilizers  
Release agents  
Lubricants  
10 Flameproofing agents  
UV absorbers  
Antiknocking agents  
Corrosion inhibitors  
Metal deactivators  
15 Carburettor cleaning agents  
Residue converters  
Antiicing agents  
Pour point depressors  
Defoamers  
20 Lubricity improvers  
Optical brighteners

Antifoams:

Anionic surfactants  
Polyethylene ethers  
25 Polypropylene glycol ethers  
Pluronic®  
Mixed ethers

### Inorg. peroxides:

Hydrogen peroxide  
Lithium peroxide  
Sodium peroxide  
Calcium peroxide  
Strontium peroxide  
Barium peroxide

### Org. peroxides:

10	Di-tert-butyl peroxide
	Dibenzoyl peroxide
	Per-acids
	Per-acid esters
	Ketone peroxides
	Epidioxides
15	Ascaridol
	Ergosterol peroxide

### Stabilizers:

Ethylenediaminetetraacetic acid  
Magnesium silicate

## 20 Plasticizers:

	Camphor
	Trimellitic acid
	Phosphoric acid esters
25	Azelaic acid esters
	Sebacic acid esters
	Chloroparaffins
	Diethyl phthalate
	Bis-(2-ethylhexyl) phthalate
	Diisononyl phthalate
30	Diisodoceyl phthalate
	Phthalic acid esters
	Dibutyl phthalate

Diisobutyl phthalate  
Dicyclohexyl phthalate  
Dimethyl phthalate  
Diethyl phthalate  
5      Benzyl butyl phthalate  
Butyl octyl phthalate  
Butyl decyl phthalate  
Dipentyl phthalate  
Dimethylglycol phthalate  
10     Dicapryl phthalate  
Trimellitic acid esters  
Tris-(2-ethylhexyl) trimellitate  
Dioctyl adipate  
Bis-(2-ethylhexyl) adipate  
15     Diisodecyl adipate  
Dibutyl sebacate  
Dioctyl sebacate  
Bis-(2-ethylhexyl) sebacate  
Azelaic acid  
20     Sebacic acid  
1,3-Butanediol  
1,2-Propanediol  
1,4-Butanediol  
1,6-Hexanediol  
25     Tricresyl phosphate  
Triphenyl phosphate  
Diphenyl cresyl phosphate  
Diphenyl octyl phosphate  
Bis-(2-ethylhexyl)diphenyl phosphate  
30     Tris-(2-ethylhexyl) phosphate  
Tris-(2-butoxyethyl) phosphate  
Butyl oleate  
Butyl stearate  
Triethylene glycol bis-(2-ethylbutyrate)  
35     Citric acid esters  
Acetyltributyl citrate  
Acetyltriethyl citrate

### Free radical interceptors:

10	Nitrogen monoxide
	Bis(trifluoromethyl) nitroxide
	Nitroxyl radicals
	2,2-Diphenyl-1-picrylhydrazyl
	Nitrosobenzene
	2-Methyl-2-nitroso-propane
15	Benzaldehyde tert-butyl nitrone

Wetting agents can be:

	Dimethyloctylphosphine oxide
	Dimethylnonylphosphine oxide
	Dimethyldecylphosphine oxide
	Dimethylundecylphosphine oxide
	Dimethylundecylphosphine oxide
20	N,N,-bis (3-D-gluconamidopropyl)cholamide
	N,N-Bis (3-D-gluconamidopropyl)deoxycholamide
25	Dodecylpoly(oxyethylene glycol ether)s,
	PEG (23) dodecyl ether,
	PEG (10) cetyl alcohol
	PEG (20) cetyl alcohol
	PEG (10) stearyl alcohol
30	PEG (10) oleyl alcohol
	PEG (29) oleyl alcohol
	Polyethylene glycol (10) lauryl ether
	Polyethylene glycol (8) dodecyl ether
	Polyethylene glycol (10) isotridecyl ether

Polyethyleneglycol (15) isotridecylether  
 Ethylphenol-poly(ethylene glycol ether)s  
 Lubrol  
 Thesit  
 5 Thesit  
 Cetylpyridinium chloride  
 Cetyltrimethylammonium bromide  
 3-[(3-Cholamidopropyl)dimethylammonio]-1-propanesulfonic acid  
 10 3-[(3-Cholamidopropyl)dimethylammonio]-1-hydroxypropanesulfonic acid  
 Chenodeoxycholic acid  
 Cholate, Na<sup>+</sup>  
 Deoxycholate, Na<sup>+</sup>  
 15 Glycocholate, Na<sup>+</sup>  
 Glycodeoxycholate, Na<sup>+</sup>  
 Taurocholate, Na<sup>+</sup>  
 Taurodehydrocholate, Na<sup>+</sup>  
 Taurodeoxycholate, Na<sup>+</sup>  
 20 Cyclohexyl-n-ethyl-β-D-maltoside  
 Cyclohexyl-n-hexyl-β-D-maltoside  
 Cyclohexyl-n-methyl-β-D-maltoside  
 n-Decyl-β-D-maltopyranoside  
 n-Dodecyl-beta-D-maltopyranoside  
 25 n-Octyl-β-D-maltopyranoside  
 n-Undecyl-β-D-maltoside  
 N,N-Dimethyldecylamine oxide  
 Genaminox KC  
 N,N-Dimethyldodecylamine oxide  
 30 N-Dodecyl-N,N-(dimethylammonio)butyrate  
 N-Dodecyl-N,N-(dimethylammonio)undecanoate  
 n-Dodecyl-N,N-dimethylglycine  
 N-Octyl-N,N-dimethylammonio-3-propanesulfonate  
 N-Decyl-N,N-dimethylammonio-3-propanesulfonate  
 35 N-Dodecyl-N,N-dimethylammonio-3-propanesulfonate  
 N-Tetradecyl-N,N-dimethylammonio-3-propanesulfonate  
 Decanoylsucrose

- n-Dodecanoylsucrose
- Octanoylsucrose
- n-Decyl- $\beta$ -D-glucopyranoside
- Dodecyl- $\beta$ -D-glucopyranoside
- 5 n-Heptyl- $\beta$ -D-glucopyranoside
- n-Hexyl- $\beta$ -D-glucopyranoside
- n-Nonyl- $\beta$ -D-glucopyranoside
- n-Octanoyl- $\beta$ -D-glucosylamine
- n-Octyl-beta-D-glucopyranoside
- 10 n-Decyl- $\beta$ -D-thiomaltoside
- n-Nonyl-beta-D-thiomaltopyranoside
- N,N-Bis(3-D-gluconamidopropyl)deoxycholamide
- N,N,-bis(3-D-gluconamidopropyl)cholamide
- Digitonin
- 15 Bis(2-ethylhexyl)sodium sulfosuccinate
- n-Dodecyl-N,N-dimethylglycine
- 6-O-(N-heptyl-carbamoyl)methyl- $\alpha$ -D-glucopyranoside
- N-Dodecanoyl-N-methylglycine
- Lauryl-sulfate Li<sup>+</sup>
- 20 Lauryl-sulfate, Na<sup>+</sup>
- {3-([4-tert-Octyl]-1-propanesulfonic acid, Na<sup>+</sup>
- n-Octanoyl-N-methylglucamide
- n-Nonanoyl-N-methylglucamide
- n-Decanoyl-N-methylglucamide
- 25 Ethylphenol-poly(ethylene glycol ether)s
- n-Octyl-2-hydroxyethylsulfoxide
- n-Octyl-2-hydroxyethyl sulfide
- n-Octyl-rac-2,3-dihydroxypropylsulfone
- n-octyl-rac-2,3-dihydroxypropylsulfoxide
- 30 Polyethylene glycol-polypropylene glycol copolymer
- Pluronic F-127
- $\beta$ -D-Fructopyranosyl-alpha-D-glucopyranoside monodecanoate
- $\beta$ -D-Fructopyranosyl-alpha-D-glucopyranoside monododecanoate
- PEG (9-10) nonylphenol
- 35 PEG (4.5) p-t-octylphenol
- PEG (9-10) p-t-octylphenol
- PEG (9-10) p-t-octylcyclohexyl

PEG (7-8) p-t-octylphenol  
PEG (7-8) t-octylcyclohexyl

Plant protection agents can be:

Herbicides	Insecticides	Fungicides	Other
2, 4-D	Abamectin	Acibenzolar	Chlormequat
2, 4-DB	Acephate	Azoxystrobin	Chloropicrin
Acetochlor	Acequinocyl	Benalaxyl	Choline Chloride
Acifluorfen	Acetamiprid	Benomyl	Cyclanilide
Aclonifen	Acrinathrin	Bitertanol	Dazomet
Alachlor	Alanycarb	Bromuconazole	Dichlopropene
Alloxidim	Aldicarb	Bupirimate	Dikegulac
Ametryn	Alpha-cypermethrin	Captan	Dimethipin
Amidosulfuron	Amitraz	Carbendazim	Ethepon
Aminotriazole	Azinphos-methyl	Carboxin	Flumetralin
Anilofos	Azocyclotin	Carpropamid	Gibberellic acid
Asulam	Bacillus thuringiensis	Chlorothalonil	Inabenfide
Atrazine	Bendiocarb	Chlozolinate	Maleic hydrazide
Azimsulfuron	Benfuracarb	Copper fungicides	Mepiquat
Benazolin	Bensultap	Cymoxanil	Metam
Benfluralin	Benzoximate	Cyproconazole	Methyl bromide
Benfuresate	Bifenazate	Cyprodinil	Methyl isothiocyanate
Bensulforon	Bifentrin	Dichlofluanid	Paclobutrazol
Bentazone	BPMC (Fenobucarb)	Diclomezine	Prohexadione
Benzofenap	Bromopropylate	Diethofencarb	Thidiazuron
Bifenox	Buprofezin	Difenoconazole	Triapenthenol
Bilanafos	Cadusafos	Dimethirimol	Tributyl phosphorotri-thioate
Bispyribac-sodium	Carbaryl	Dimethomorp	Trinexapac-ethyl
Bromacil	Carbofuran	Diniconazole	Uniconazole
Bromobuthide	Carbosulfan	Dinocap	Fluthiacet - KIH 9201 / CGA 248757
Bromofenoxim	Cartap	Dithianon	

Bromoxynil	Chinomathionat	Dodemorph	
Butachlor	Chlorethoxyfos	Dodine	
Butamifos	Chlorfenapyr	Edifenphos	
Butralin	Chlorfenvinphos	Epoxiconazole	
Butroxydim	Chlorfluazuron	Ethaboxam	
Butylate	Chlormephos	Ethirimol	
Cafenstrole	Chloropirifos	Etridiazole	
Carbentamide	Clofentezine	Famoxadone	
Carfentrazone	Cycloprothirin	Fenarimol	
Chlorbromuron	Cyfluthrin	Fenbuconazole	
Chloridazon	Cyhexatin	Fenhexamid	
Chlorimuron	Cypermethrin	Fenitropan	
Chlorotoluron	Cyromazine	Fenpiclonil	
Chlorsulfuron	Deltamethrin	Fenpropidin	
Chlorthal	Demeton-s-methyl	Fenpropimorph	
Cinidon-ethyl	Diafenthiuron	Fentin	
Cinmethylin	Diazinon	Ferimzone	
Cinosulfuron	Dichlorvos	Fluazinam	
Clefoxydim	Dicofol	Fludioxonil	
Clethodim	Dicrotophos	Fluoroimide	
Clodinafop	Diflubenzuron	Fluquinconazole	
Clomazone	Dimethoate	Flusilazole	
<b>Herbicides</b>	<b>Insecticides</b>	<b>Fungicides</b>	<b>PGR</b>
Clomeprop	Disolfoton	Flusulfamide	Aminoethoxy-vinylglycine
Clopyralid	Emamectin benzoate	Flutolanil	Prohydrojasmon - PDJ
Cloransulam-methyl	Endosulfan	Flutriafol	
Cumyluron	Esfenvalerate	Folpet	
Cyanazine	Ethiofencarb	Fosetyl	
Cyclosulfamuron	Ethion	Fuberidazole	
Cycloxydim	Ethoprophos	Furalaxyl	
Cyhalofop-butyl	Etofenprox	Furametpyr	
Daimuron	Etoxazole	Guazatine	
Desmedipham	Etrifos	Hexaconazole	

Desmetryn	Fenamiphos	Hymexazol	
Dicamba	Fenazaquin	Imazalil	
Dichlobenil	Fenbutatin oxide	Imibenconazole	
Dichlorprop	Fenitrothion	Iminoctadine	
Diclofop	Fenothiocarb	Ipconazole	
Diclosulam	Fenoxy carb	Iprobenfos	
Difenzquat	Fenprothrin	Iprodione	
Diflufenican	Fenpyroximate	Iprovalicarb	
Diflufenzopyr	Fenthion	Isoprothiolane	
Dimefuron	Fenvaleate	Kasugamycin	
Dimepiperate	Fipronil	Kresoxim-methyl	
Dimethachlor	Flubrothirinate	Mancozeb	
Dimethenamid	Flucycloxuron	Maneb	
Diphenamid	Flucythrinate	Mepanipyrim	
Diquat	Flufenoxuron	Mepronil	
Dithiopyr	Flutenzine	Metalaxyl	
Diuron	Fluvalinate	Metconazole	
Endothal	Formetanate	Methasulfocarb	
EPTC	Formothion	Metiram	
Eprocarb	Fosthiazate	Myclobutanil	
Ethalfluralin	Furathiocarb	Nitrothal-isopropyl	
Ethametsulfuron	Halfenbrox	Nuarimol	
Ethofumesate	Halofenozide	Oxadixyl	
Ethoxyfen	Hexaflumuron	Oxine-copper	
Ethoxysulfuron	Hexythiazox	Oxolinic acid	
Etobenzanid	Imidacloprid	Oxycarboxin	
Fenoxaprop	Indoxacarb	Pefurazoate	
Flamprop-M	Isofenphos	Penconazole	
Flazasulfuron	Isoprocarb	Pencycuron	
Fluazifop	Isoxathion	Phthalide	
Flufenacet	Lambda-cyhalothrin	Probenazole	
Flumetsulam	Lindane (Gamma-HCH)	Prochloraz	
Flumiclorac-	Lufenuron	Procymidone	

<b>pentyl</b>			
Flumioxazin	Malathion	propamocarb	
Fluometuron	Metaldehyde	Propiconazole	
Fluoroglycofen	Methamidophos	Propineb	
Flupoxam	Methidathion	Pyrazophos	
Flupyrsulfuron	Methiocarb	Pyrifenoxy	
<b>Herbicides</b>	<b>Insecticides</b>	<b>Fungicides</b>	<b>Nematicides</b>
Flurenol	Methomyl	Pyrimethanil	ZA3274
Fluridone	Methoprene	Pyroquilon	
Flurochloridone	Methoxyfenozide	Quinoxifen	
Fluroxypyr	Mevinphos	Quintozene	
Flurtamone	Milbemectin	Spiroxamine	
Fomesafen	Monocrotophos	Streptomycin	
Glufosinate	Nitenpyram	Sulfur	
Glyphosate	Novaluron	Tebuconazole	
Halosulforon	Omethoate	Tecloftalam	
Haloxylfop	Oxamyl	Tetraconazole	
Imazamethabenz	Oxydemeton-methyl	Thiabendazole	
Imazamox	Parathion	Thifluzamide	
Imazapic	Parathion-methyl	Thiophanate-methyl	
Imazapyr	Permethrin	Thiram	
Imazaquin	Phenthroate	Tolclofos-methyl	
Imazethapyr	Phorate	Tolylfluanid	
Imazosulfuron	Phosalone	Triadimefon	
Isoprothuron	Phosmet	Triadimenol	
Isoxaben	Phosphamidon	Tricyclazole	
Isoxaflutole	Phoxim	Tridemorph	
Lactofen	Pirimicarb	Triflumizole	
Lenacil	Pirimiphos-ethyl	Triforine	
Linuron	Pirimiphos-methyl	Triticonazole	
MCPA	Profenofos	Validamycin	
MCPA-thioethyl	Propaphos	Vinclozolin	
MCPB	Propargite	Zineb	
Mecoprop	Propoxur	Ziram	

Mefenacet	Prothiofos	Cyamidazosulfamid - IKF-916
Metamitron	Pymetrozine	
Metazachlor	Pyraclofos	Cyamidazosulfamid- IKF-916
Methabenzthiazuron	Pyridaben	
Methyl-arsonic acid	Pyridafenthion	Diclocymet - S2900
Metobromuron	Pyrimidifen	Fenamidone - RPA 407213
Metolachlor	Pyriproxyfen	
Metosulam	Quinakphos	Fenoxyanil - AC382042 /NNF9425
Metoxuron	Silafluofen	
Metribuzin	Spinosad	Iprovalicarb-SZX722
Metsulfuron	Sulprofos	MA 565
Molinate	Tebufenozide	Metominostrobin - SSF-126
Naproanilide	Tebufenpyrad	
Napropamide	Tebupirimfos	MTF-753
Naptalam	Teflubenzuron	NF-149
Nicosulfuron	Tefluthrin	NNF-9850
Norflurazon	Terbufos	Oxoconazole fumarate - UBF-910
Orbencarb	Thiamethoxam	
Oryzalin	Thiocyclam	Picoxystrobin - ZA1963
Oxadiargyl	Thiodicarb	
Oxadiazon	Thiometon	
<b>Herbicides</b>	<b>Insecticides</b>	<b>Fungicides</b>
Oxasulfuron	Tralomethrin	Silthiopharm - MON-65500
Oxyfluorfen	Triazamate	
Paraquat	Triazophos	Simeconazole - F155
Pendimethalin	Trichlorfon	Trifloxystrobin

		- OGA279202
Pentoxazone	Triflumuron	
Phenmedipham	Vamidothion	Zoxamide - RH7281
Picloram	Xylol methylcarbamate	
Pretilachlor	Zeta-Cypermethrin	
Primisulfuron	Acetoprole-RPA115782	
Prometryn	<b>AKD 1022</b>	
Propachlor	Chromafenozide-ANS-118	
Propanil		
Propaquizafop	Clothianidin - TI-435	
Propazine	Dinitefuran - MTI-446	
Propyzamide	Ethiprole-RPA 107382	
Prosulfocarb	Fluacrypyrim - NA-83	
Prosulfuron	Flupyrazofos	
Pyraflufen-ethyl	Phosphocarb - BAS301	
Pyrazolinate		
Pyrazosulfuron	Protrifenbute - FMC 111869	
Pyrazoxyfen		
Pyribenzoxim	Thiacloprid - BAYYRC2894	
Pyributicarb		
Pyridate	Tolfenpyrad - OMI-88	
Pyriminobac-methyl		
Pyrithiobac		
Quinclorac		
Quinmerac		
Quinoclamine		
Quizalofop		

Quizalofop-P- tefuryl		
Rimsulfuron		
Sethoxydim		
Simazine		
Sulcotrione		
Sulfentrazone		
Sulfometuron		
Sulfosate		
Sulfosulfuron		
Tebuthiuron		
Terbacil		
Terbumeton		
Terbutylazine		
Terbutryn		
Thenylchlor		
Thiazopyr		
Thifensulfuron		
Thiobencarb		
<b>Herbicides</b>		
Tralkoxydim		
Triallate		
Triasulfuron		
Tribenuron		
Triclopyr		
Trifluralin		
Triflusulfuron		
Amicarbazone-BAYMKH3586		
Azafenidin-DPX-R6447		
Beflubutamid-UBH-820		
Benzfendizone - FMC 143686		
Benzobicyclon -SB-500		
Butafenacil - CGA 276854		
Fentrazamide - BAYYRC2388		
Florasulam - DE570		

Fluazolate - JV485
Flucarbazone - BAYMKH6562
Flufebpyr-ethyl - S-3453
Foramsulfuron - AEF 130360
Indanofan - MK-243
Iodosulfuron - AEF 115008
Isoxadifen - AEF122006
KPP421
Mesosulfuron - AEF 130060
Mesotrione - ZA1296
MTB-951
OK-9701
Oxaziclofone-MY-00
Penoxsulam - DE638
Pethoxamid - TKC-94
Picolinofen - AC900001
Propoxycarbazone (proposed) BAYMKH6561
Pyriftalid - CGA279233
Tepraloxydin - BAS620H/NP61EC
Triaziflam - IDH 1105
Trifloxysulfuron (Na salt) - CGA362622
Tritosulfuron

Preferably, however, the silicon dioxide granules employed according to the invention function as a carrier. The

5 present invention therefore also relates to an adsorbate of the silicon dioxide granules described above and at least one of these substances.

The term "adsorbate" as used herein includes the adsorption of a substance not only on to the surface of the silicon

10 dioxide, but also into the pores, as well as the

"intercalation" into the intergrain volumes. "Adsorbate" can also mean that silicon dioxide granules or fragments thereof envelop solid particles or liquid droplets of the substance. In the latter case the forces of attraction

5 between the particles or droplets are reduced and, for example, the flow properties are improved or the merging of droplets is impeded.

The ratio of amounts of substance to silicon dioxide granules in the adsorbate can be chosen as desired as a

10 function of the properties of the substance and the requirements for the end product. Preferably, however, 0.001 to 200 g of substance are employed per 100 g of silicon dioxide granules, particularly preferably 10 to 150 g.

15 In a preferred embodiment, granules based on pyrogenically prepared silicon dioxide of average particle diameter from 10 to 120  $\mu\text{m}$  and BET surface area from 40 to 400  $\text{m}^2/\text{g}$  (determination in accordance with DIN 66 131 with nitrogen) can be used as the silicon dioxide granules.

20

The silicon dioxide granules furthermore preferably have the following physico-chemical characteristic data, which are determined as described in EP PS 0 725 037:

Pore volume: 0.5 to 2.5 ml/g

25 Pore size volume: less than 5% of the total pore volume has a pore diameter of less than 5 nm, remainder meso- and macropores

pH: 3.6 to 8.5

Tamped density: 220 to 700 g/l.

30

Granules which are suitable for the use according to the invention and the preparation thereof are described, for example, in EP OS 0 727 037.

5 An example of a process for the preparation of the adsorbate according to the invention comprises:

Melting of the substance(s) to be adsorbed, chosen from foodstuffs additives, such as dyestuffs, antioxidants, preservatives, emulsifiers, gelling agents, thickeners and binders, stabilizers, alkalis, acids, salts, antilumping 10 agents, flavour intensifiers, sweeteners, aromas, feedstuffs additives, chemical intermediates and plant protection agents, such as, for example, herbicides, insecticides and fungicides, or distribution, i.e. dissolving, suspending or emulsifying, thereof in a 15 solvent;

mixing of the granules based on pyrogenically prepared silicon dioxide with the mixture from step (a); and where appropriate removal of the solvent.

"Solvent" also includes mixtures of several different 20 solvents. It goes without saying, furthermore, that substances which are already liquid at room temperature can be subjected to the mixing in step (b) without prior processing, since in this case the "melting operation" has already taken place. Mixing step (b) can be carried out 25 either by adding the mixture from step (a) to the silicon dioxide granules, for example by spraying on, or vice versa. In both cases, the addition can be made in one amount or in portions. The duration of the mixing in step (b) depends here above all on the adsorption properties of 30 the substance to be adsorbed on the silica surface. If a solvent is present, step (a) and (b) are carried out at a temperature which lies between the freezing and boiling point of the solvent. The solvent, where appropriate in

excess, is preferably removed in step (c) at elevated temperature and/or under reduced pressure.

The removal of the solvent in step (c) can also be carried out by spray drying or fluidized bed drying, shaping taking 5 place at the same time. In the case of a granule-containing melt, the shaping process can accordingly be an extrusion.

The adsorbates according to the invention can be used for the preparation of powders, liquids, foams, sprays, gels, creams, ointments, pastes, sticks and tablets.

10 The adsorbates according to the invention can additionally be shaped. They can be processed, for example, to pellets, larger granules, extrudates etc.

The advantage of the adsorbates according to the invention lies in their excellent flow properties, the low water 15 content and the high purity of the starting granules. They offer a very good possibility for dispersing substances which are difficult to meter, and are easy to handle.

When handling the adsorbates, the hazard potential to the administering person during use on toxic substances, such 20 as plant protection agents or aggressive skin-irritating substances, can be reduced significantly.

When the adsorbate according to the invention is used, a uniform distribution of the active compound can be achieved.

25 The invention is now to be explained in more detail with the aid of examples.

**Preparation of granules based on pyrogenically prepared silicon dioxide**

The pyrogenically prepared silicon dioxide AEROSIL 300, commercially obtainable from Degussa AG, is used as the starting compound.

The pyrogenically prepared silicon dioxide is dispersed in completely demineralized water. A dispersing unit which operates by the rotor/stator principle is used here. The suspension formed is spray dried. The finished product is separated off via a filter or cyclone. The heat treatment of the spray granules is carried out in a muffle oven.

The preparation parameters are shown in table 1.

**Table 1**

Starting SiO <sub>2</sub>	AEROSIL 300
Spray drying data	
Amount of H <sub>2</sub> O (kg)	100
Amount of SiO <sub>2</sub> (kg)	10
Atomization with	disc atomizer
Operating temperature (°C)	480°C
Waste air temperature (°C)	103°C
Separation	filter
Physico-chemical data	
BET surface area (m <sup>2</sup> /g)	298
Particle size d <sup>50</sup> (μm)	30
Tamped volume (g/l)	283
pH	4.7

**Examples****1. Starting materials****1.1 Model liquids**

5 Vitamin E acetate, silicone oil, paraffin oil and eucalyptus oil are used as model liquids for the fields of use according to the invention. Vitamin E acetate is used, for example, in the nutrition of animals and humans, and eucalyptus oil as an aromatic or aroma substance.

Example	Product	Product name	Manufacturer
1	Vitamin E acetate		BASF
2	Silicone oil	Silicon Fluid 345	Dow Corning
3	Paraffin oil	Paraffinöl dünflüssig	Merck
4	Eucalyptus oil	Oleum Eucalypti 80-85%	Caelo

## 1.2 Carrier silicas

Silica	Loss on drying (wt.%)	Loss on ignition (wt.%)	SiO <sub>2</sub> content (wt.%)	Slope angle (°)	Bulk density (g/l)
Example 1-4 AEROPERL® 300/30 (Degussa)	1.7	2.1	99.9	34.97	232.8
Comparison example 1 SIPERNAT® 22 (Degussa)	4.8	4.4	98.0	38.99	211
Comparison example 2 SIPERNAT® 50 (Degussa)	4.5	4.9	98.5	52.67	136.67
Comparison example 3 Syloid 244 FP (Grace)	5.9	3.9	nd	50	92

Granulated pyrogenic silica (AEROPERL® 300/30) has a significantly lower water content (loss on drying and ignition) and a higher silicon dioxide content than the silicas used in the comparison examples. Furthermore, it is free from sulfates, typical impurities of precipitated silica and silica gels, and has the best flowability (the lowest slope angle).

2. Procedure:

50 g of carrier silica are initially introduced into a 2 litre three-necked flask equipped with a blade stirrer. 50 g of the model liquids from examples 1-4 are added dropwise from a dropping funnel in the course of 60 minutes, while stirring at a stirrer speed of 100 revolutions / minute. Comparison examples 1-3 are carried out with eucalyptus oil. The liquid-silica adsorbates are

then sieved manually three times through a 0.8 mm sieve and left to stand overnight in a closed screw-cap glass bottle. The following day, the liquid-silica adsorbates are characterized by the following methods:

5

Flow rating by means of glass flow vessels in accordance with the publication series Pigmente No. 31 "AEROSIL zur Verbesserung des Fließverhaltens pulverförmiger Substanzen", Degussa AG, Düsseldorf.

10 Poured cone height (cm) or slope angle ( $^{\circ}$ ) in accordance with the publication series Pigmente No. 31. The slope angle is obtained from the poured cone height via the equation

$$\tan(\text{slope angle}) = (\text{poured cone height}/0.5 \text{ cone diameter})$$

15 Bulk density (g/l) in accordance with DIN standard 6613.

## 3. Results

	Flow rating	Slope angle (°)	Bulk density (g/l)
Example 1 AEROPERL / Vitam. E	2	30.1	501
Example 2 AEROPERL / Silicone oil	2	37.2	475
Example 3 AEROPERL / Paraffin oil	2	38.7	497
Example 4 AEROPERL / Eucalyptus oil	2	37.2	594
Comparison example 1 SIPERNAT 22	3	46.0	450
Comparison example 2 SIPERNAT 50	4	63.9	353
Comparison example 3 Sylloid FP 244	6	56.7	201

The liquid-silica adsorbates prepared with granulated pyrogenic silica (AEROPERL® 300/30) are distinguished by a 5 good flowability (flow rating 2, slope angle < 40°C). In contrast, the liquid-silica adsorbates from comparison examples 1 to 3 show a significantly lower flowability. The latter moreover have significantly lower bulk densities.

Liquid-silica adsorbates with a good flowability and high 10 bulk volume are advantageous for carrier uses. Furthermore, carrier silicas should have the lowest possible water content and should be very pure, in order to avoid decomposition of the adsorbed liquids under the (catalytic) influence of water or impurities, such as, for example,

sulfates. The experiments show that granulated pyrogenic silica meets all these requirements.